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February 17, 1998

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FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

Via HAND DELIVERY

Ms. Magalie Roman Salas  
Secretary  
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1919 M Street, N.W.  
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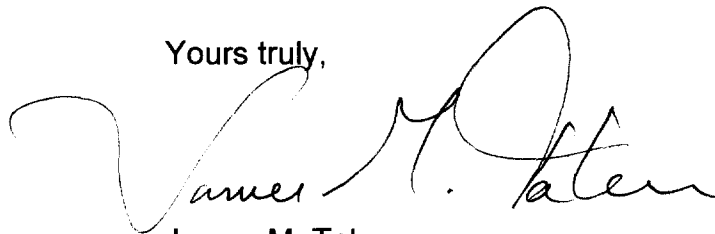
**Re: Reconsideration of the Third Report and Order in CC Dkt. No. 92-297**

Dear Ms. Salas:

Enclosed for filing are an original and four copies of the Reply of Motorola Global Communications, Inc. in the above-referenced proceeding. Please date stamp and return the extra copy that is enclosed.

Please do not hesitate to contact us if you have any questions.

Yours truly,



James M. Talens  
**Counsel for Motorola Global  
Communications, Inc.**

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**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, DC 20554**

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FEB 17 1998

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

**In the Matter of**

**Rulemaking to Amend Parts 1, 2, 21 and 25  
of the Commission's Rules to Redesignate  
the 27.5-29.5 GHz Frequency Band, to  
Reallocate the 29.5-30.0 GHz Frequency  
Band, to Establish Rules and Policies for  
Local Multipoint Distribution Service and  
for Fixed Satellite Services**

**CC Docket No. 92-297**

**REPLY OF MOTOROLA GLOBAL COMMUNICATIONS, INC.**

Motorola Global Communications, Inc. ("Motorola")<sup>1</sup>, in further support of its Petition for Reconsideration and/or Clarification of the Commission's Ka-Band Service Rules<sup>2</sup> ("Petition"), hereby replies to the Consolidated Comments of Lockheed

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<sup>1</sup> Motorola has an interest in this proceeding because it is a Commission licensee and an applicant in the Ka band. See Application of Comm. Inc. to Construct, Launch, and Operate a Ka-Band Satellite System in the Fixed-Satellite Service, Order and Authorization ("Millennium System"), FCC 97-968 (Int'l Bureau, May 9, 1997); Application for Authority to Construct, Launch and Operate the Celestri Multimedia LEO System ("Celestri™ LEO System"), File No. 79-SAT-P/LA-97, filed June 13, 1997; Application for Authority to Construct, Launch, and Operate the Celestri GEO System, Files Nos. 94 through 98-SAT-P/LA-97, filed July 15, 1997. Celestri is a trademark of Motorola, Inc. Motorola and Comm, Inc. are wholly-owned subsidiaries of Motorola, Inc.

<sup>2</sup> See Rulemaking to Amend Parts 1, 2, 21 and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services, Third Report and Order, CC Dkt. No. 92-297 (released Oct. 9, 1997) ("Ka-Band Service Rules").

Martin Corporation ("Lockheed Martin") and the Opposition of Teledesic Corporation ("Teledesic"), each of which was filed on February 5, 1998.

**I. A MINIMUM ELEVATION ANGLE SERVES THE PUBLIC INTEREST AND WILL NOT RESULT IN REDUCED COVERAGE IN MORE NORTHERN LATITUDES**

In its Ka-Band Services Rules, the Commission stated that it was "adopting the same coverage requirements" for Ka-band systems that it applies to "Big LEO" MSS systems.<sup>3</sup> As Motorola discussed in its Petition, however, the Commission's new rules did not specifically include the important clarifying language contained in the Big LEO MSS rules regarding coverage that only requires at least one satellite to be visible above the horizon at an elevation angle of 5°.<sup>4</sup>

Lockheed Martin contends that the Commission must have purposely excluded the reference in the new Ka-band rules to a specific minimum elevation angle because each Ka-band NGSO FSS system is designed to operate at different minimum elevation angles.<sup>5</sup> This contention is not only technically incorrect, but also contradicts the clear language of the Commission's order and ignores the valuable public interest purpose of a minimum elevation angle requirement for Ka-band NGSO FSS systems.

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<sup>3</sup> See id. ¶ 34.

<sup>4</sup> Petition at 3-4; see Section 25.143(b)(ii)-(iii), 47 C.F.R. §§ 25.143(b)(ii)-(iii) (1996); see also Section 25.145(c)(1)-(2), 47 C.F.R. § 145(c)(1)-(2).

<sup>5</sup> Lockheed Martin Comments at 5.

For its part, Teledesic argues that a 5° minimum elevation angle is inadequate for the Celestri LEO System to provide the coverage required by the Commission's new rules. Motorola, however, has demonstrated in its application proceeding that the Celestri LEO System can provide domestic and global coverage in full compliance with Section 25.145(c)(1)-(2) of the Rules.

**A. Specification of a Minimum Elevation Angle Assures Compliance With the Commission's Coverage Requirements**

Specification of a minimum elevation angle provides the Commission and applicants with an objective basis for determining whether an NGSO satellite system is meeting the geographic coverage requirements. It makes no difference whether the NGSO system is operating in the Big LEO MSS band or the Ka-band.

Contrary to Lockheed Martin's contention, NGSO FSS systems are not at all limited to providing service at specific elevation angles. While it might be true that NGSO FSS systems are designed for optimal efficiency at particular elevation angles, it is technically incorrect to suggest that Ka-band service at lower elevation angles cannot be provided on a reliable basis. Establishment of a minimum elevation angle is a sensible and practical way for the Commission to assure that a proposed NGSO FSS system can provide the domestic and global coverage required under Section 25.145(c)(1)-(2) of the Rules. The Commission used this approach in the Big LEO MSS rules and it should do so explicitly for the Ka-band NGSO FSS systems, as it stated it would in its order.

Teledesic asserts that applying a “multi-factored, qualitative evaluation” to ascertain coverage compliance is preferable to relying on a quantitative coverage test.<sup>6</sup> Teledesic predicts that a 5° minimum elevation angle requirement will result in inadequate coverage in the northern-most latitudes or “wasted” spectrum in the Ka-band.<sup>7</sup> Teledesic is wrong on both points.

While Teledesic may prefer that an undefined qualitative standard replace objective quantitative criteria, it is axiomatic that a measurable performance threshold is a necessary component to assuring ascertainable and consistent compliance with performance goals. The Commission’s coverage objectives are no exception. By establishing measurable elevation angle criteria, proposed NGSO FSS systems’ compliance can be fairly assessed. Teledesic’s more general qualitative test simply makes no sense for Ka-band NGSO FSS systems.

As explained in its Petition, a minimum elevation angle serves the public interest and will not result in reduced service coverage, in northern latitudes or elsewhere.

#### **B. Teledesic’s Warnings of Severe Rain Attenuation and Terrestrial Obstruction Are Without Foundation**

Teledesic contends that a minimum elevation angle requirement of 5° for NGSO FSS systems in the Ka-band would cause “serious degradation of service quality

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<sup>6</sup> See Teledesic Opposition at 2.

<sup>7</sup> See *id.* at 3-4.

due to rain attenuation.”<sup>8</sup> Teledesic also foresees increased signal blockage from terrestrial obstructions at low elevation angles.<sup>9</sup> Neither of these contentions has merit.

Teledesic proffers data in support of its claim that low elevation angles radically increase rain attenuation and therefore will prevent the Celestri LEO System from providing reliable service.<sup>10</sup> These data, however, depict rain attenuation in New York City, rather than at the far northern latitudes where Motorola's Celestri LEO System will employ lower elevation angles, i.e., above 64° North Latitude.<sup>11</sup> Indeed, as Teledesic notes, New York City, at 40.42° North Latitude, is in CCIR Rain Region K.<sup>12</sup> The correct rain attenuation region for locations at which the Celestri LEO System will use lower elevation angles is Rain Region A, which is the lowest rain region in the CCIR model.<sup>13</sup>

The Celestri LEO System and most other inclined orbit NGSO FSS systems are designed to optimize service for latitudes below approximately 60°. While rain attenuation for the Ka-band could be severe in some locations below 60° in latitude

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<sup>8</sup> Teledesic Opposition at 6.

<sup>9</sup> Id.

<sup>10</sup> Id. at 7 (figs. 1, 2).

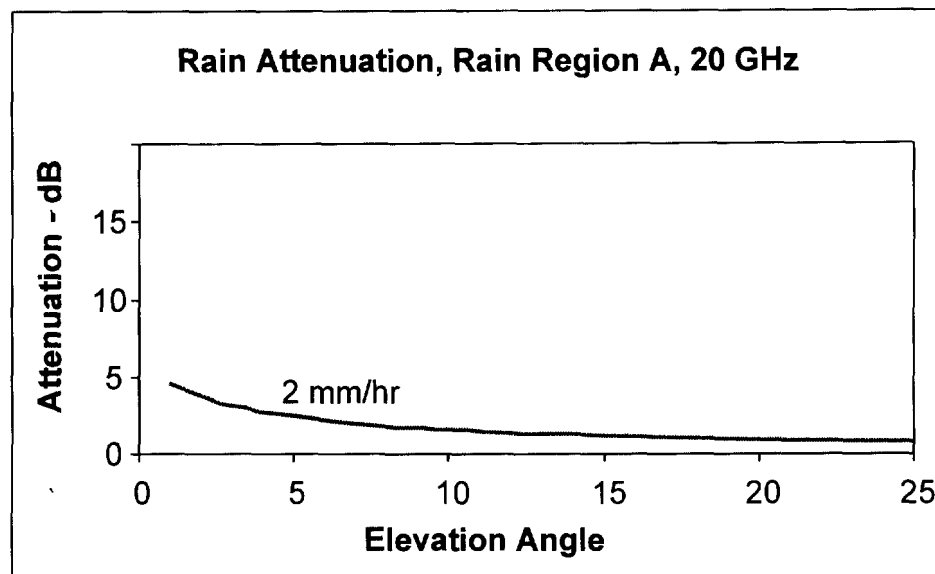
<sup>11</sup> A 5° elevation angle is necessary only at the very northern edge of the Celestri LEO System coverage area, i.e., at 71.38° North Latitude, which is also the northernmost point in the U.S. At locations south of that point, the angle of elevation is higher.

<sup>12</sup> Teledesic Opposition at 7.

<sup>13</sup> See Propagation Effects Handbook for Satellite Systems, NASA Reference Publication 1082(04), 1989 (N89-17060), The CCIR Model (pages 3-44).

when using a 5° elevation angle, it is minimal for Rain Region A locations, as shown in Figure 1, below.<sup>14</sup>

Thus, Teledesic's analysis concerning rain attenuation at a 5° elevation angle for coverage of New York City is irrelevant. Moreover, contrary to Teledesic's erroneous assertions, the Celestri LEO System availability figures remain high under all CCIR model rain environments in its intended service area.



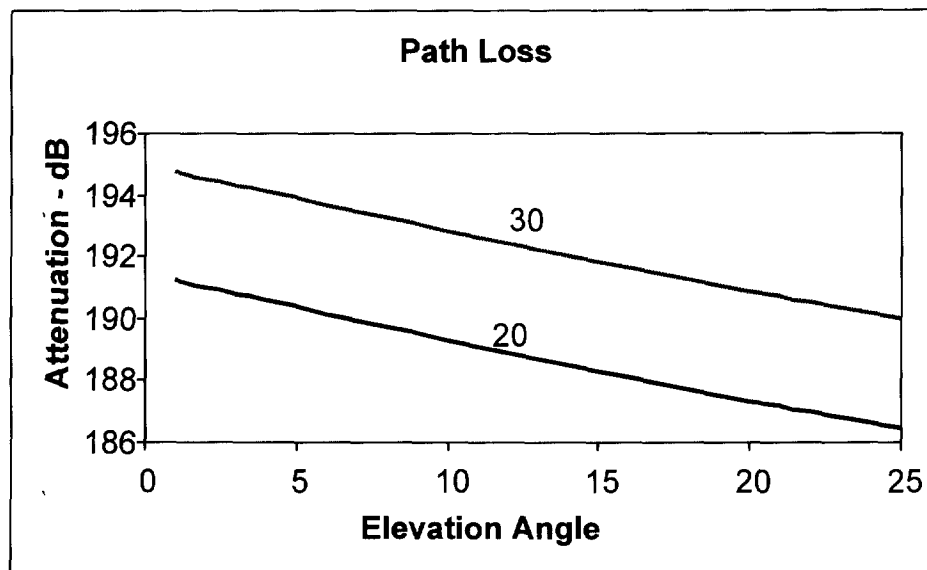
Rain Attenuation at 20 GHz  
Figure 1

Teledesic's contentions regarding terrestrial obstruction and slant range loss, i.e., loss from the longer path associated with a lower elevation angle, are also misleading and incorrect. First, there are fewer "terrestrial obstructions" at such extreme northern latitudes than at lower latitudes. Second, larger antennas, where

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<sup>14</sup> At a rain rate of 2 mm/hr, the availability of the Celestri LEO System will be 99.9%.

needed, will compensate for increased losses that might occur because of lower elevation angles. Third, Motorola will use all necessary means at the edges of the Celestri LEO System coverage area to assure relatively unobstructed views to satellites. For example, it will locate its terminals where there are few obstacles, atop existing structures, etc. Fourth, as shown in Figure 2, below, the measured slant range associated with a 5° elevation angle causes an increase in path loss of only 2.5dB, which is easily accommodated by the Celestri LEO System link budget. In sum, Teledesic's concerns with regard to operation of the Celestri LEO System at a 5° elevation angle are without merit.



Path Loss  
Figure 2

**C. Teledesic is Wrong in Contending That The Celestri LEO System Will Not Comply With The Commission's Coverage Requirements**

As it has in the Celestri LEO System application proceeding, Teledesic misapprehends the capabilities designed into the Celestri LEO System.<sup>15</sup> The Celestri LEO System is fully capable of providing FSS on a continuous basis throughout the fifty states, Puerto Rico and the U.S. Virgin Islands, as well as meeting the Commission's global coverage requirements. As Motorola stated in its application, "[s]ervice can be extended to beyond 70° North and South Latitude by mitigating the effects of low elevation angles."<sup>16</sup> At a nominal latitude of 70°, the minimum elevation angle to a Celestri LEO System satellite will be about 7°, and the median service elevation angle will be 12°. At 71.38° North Latitude where Point Barrow, Alaska is located – the northern most location in the U.S. – the median service angle is 10°, and the minimum elevation angle is 5°.

Teledesic erroneously predicts that a minimum elevation angle of 5° will result in service that is only "theoretical" because "users will be forced to use larger earth terminals to access the Celestri system."<sup>17</sup> As Motorola has stated, the Celestri LEO System can use larger antennas than those contemplated for more temperate

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<sup>15</sup> Teledesic Opposition at 4-5; see Motorola's Consolidated Opposition and Reply Comments in the Celestri LEO System and Celestri GEO System application proceeding, FCC File Nos. 79-SAT-P/LA-97, and 94 through 98-SAT-P/LA-97.

<sup>16</sup> Celestri LEO Application at 37.

<sup>17</sup> Teledesic Opposition at 7.

latitudes to assure highly reliable links with satellites in view.<sup>18</sup> Contrary to Teledesic's technical speculation, larger antennas are, in fact, consistently used in the satellite industry to extend the coverage of satellite communications systems. The coverage they facilitate is hardly "theoretical" because larger antennas compensate for loss in signal strength that occurs due to lower elevation angles. Moreover, the simultaneous application of satellite diversity and frequency management interference mitigation techniques permits exceptional reliability even at what Teledesic calls "extreme" northern latitudes. The Celestri LEO System will provide broadband digital services in full compliance with Section 25.145(c)(1)-(2) of the Commission's Rules.

## **II. CONCLUSION**

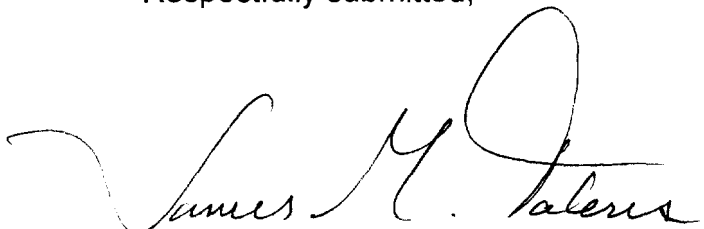
For the reasons set forth above and as discussed in its Petition, Motorola requests that the Commission reconsider or clarify the language it adopted in Section 25.145(c)(1)-(2) of the Rules by specifically including the 5° elevation angle satellite visibility criterion that appears in Section 25.143(b)(ii)-(iii). By so doing, the Commission will clarify the measure of geographic coverage required of Ka-band NGSO FSS applicants, and it will fulfill its stated intention to apply the same standard to both Big

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<sup>18</sup> Teledesic misquotes Motorola's application on this point, referring to "larger earth terminals" rather than "antennas" and exaggerating the need for "non-standard equipment." Teledesic Opposition at 4, 5, 7-8; see Celestri LEO System Application at 78; Motorola's Consolidated Opposition and Reply Comments at 23.

LEO MSS and Ka-band NGSO FSS systems.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "James M. Talens". The signature is fluid and cursive, with a large loop at the end.

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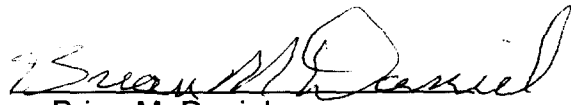
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February 17, 1998

## ENGINEERING CERTIFICATION

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this Reply, that I am familiar with Part 25 of the Commission's Rules, that I have either prepared or reviewed the engineering information submitted in this Reply, and that it is complete and accurate to the best of my knowledge and belief.

By:   
Brian M. Daniel  
Principal Project Engineer  
Advanced Systems Division  
Space and Systems Technology Group

February 17, 1998

## CERTIFICATE OF SERVICE

I hereby certify that I caused the foregoing Reply to be served this 17<sup>th</sup> day of February, 1998, by hand\* or by first-class mail, to the following persons:

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